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# ELECTRIC VEHICLE

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H02M7/48

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Application number: JP19950258988 19951005

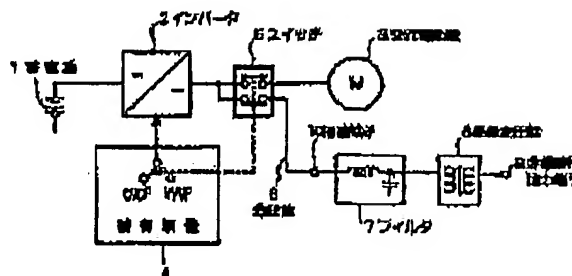
Priority number(s): JP19950258988 19951005

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## Abstract of JP9103002

**PROBLEM TO BE SOLVED:** To provide an ordinary electric vehicle provided with a function replaceable with an independent emergency power supply or power supply vehicle through simple structure.

**SOLUTION:** The inventive electric vehicle comprises a battery 1, an inverter 2 for converting DC output from the battery 1 into AC output in variable frequency variable voltage control mode or fixed frequency fixed voltage control mode, an AC motor 3 being driven with the AC output from inverter 2 operating in variable frequency variable voltage control mode, and an emergency output terminal 4 for deriving the AC output from inverter 2 operating in fixed frequency fixed voltage control mode.



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## CLAIMS

[Claim 1] The electric vehicle equipped with the output terminal for emergencies which derives the ac output of the AC motor driven by the ac output of a battery, the inverter which can change the dc output of this battery into an ac output by the control mode of a variable frequency and an adjustable electrical potential difference, or the control mode of fixed frequency and a fixed electrical potential difference, and said inverter operated by the control mode of a variable frequency and an adjustable electrical potential difference, and said inverter operated by the control mode of fixed frequency and a fixed electrical potential difference.

[Claim 2] The electric vehicle equipped with the switch switched so that the ac output of the fixed frequency and the fixed electrical potential difference drawn by the output terminal for emergencies may be drawn through the coil inductance of said AC motor under shutdown in an electric vehicle according to claim 1.

[Claim 3] The electric vehicle equipped with the output terminal for emergencies which derives the ac output of said AC motor operated as the ac output and the generator of the AC motor driven by the ac output of a battery, the inverter which can operate the dc output of this battery by the control mode of a variable frequency and an adjustable electrical potential difference, or the control mode of fixed frequency and a fixed electrical potential difference, and said inverter operated by the control mode of a variable frequency and an adjustable electrical potential difference, the internal combustion engine which does auxiliary actuation of this AC motor, and said inverter operated by the control mode of fixed frequency and a fixed electrical potential difference.

[Claim 4] A battery and the power converter which can be operated as an inverter or a rectifier by the control mode of a variable frequency and an adjustable electrical potential difference, or the control mode of fixed frequency and a fixed electrical potential difference. The output terminal for emergencies which derives the ac output of said power converter by which inverter operation is carried out by the control mode of fixed frequency and a fixed electrical potential difference. While driving by the ac output of the internal combustion engine which has the capacity that an automobile can be promoted, and said power converter by which inverter operation is carried out by the control mode of a variable frequency and an adjustable electrical potential difference and propelling an automobile in collaboration with said internal combustion engine. The electric vehicle equipped with the AC motor which makes said battery charge by the dc output of said power converter by which drives with said internal combustion engine, and functions as a generator, and rectifier operation is carried out by the control mode of a variable frequency and an adjustable electrical potential difference by considering the generation of electrical energy electrical potential difference as an input.

[Claim 5] The current detection equipment which detects the output current of said inverter in an electric vehicle according to claim 3. The coordinate transformation machine which divides into the active current and the reactive current the output current detected by this current detection equipment. The electric vehicle equipped with the current control means which calculates the rate command for controlling the active current separated with this coordinate transformation vessel to a predetermined value, and a speed-control means to control said internal combustion engine's rate based on the rate command computed by this current control means.

[Claim 6] The electric vehicle equipped with an electrical-potential-difference detection means to detect the output voltage of said battery, a judgment means by which the electrical potential difference detected by this electrical-potential-difference detection means judges whether it is below a predetermined value, and a means to stop the electric power supply to said output terminal for emergencies when judged with a detection electrical potential difference being below a predetermined value by this judgment means, in the electric vehicle according to claim 1 to 4.

[Claim 7] The electric vehicle equipped with the terminal which connects external DC power supply to said battery and juxtaposition in the electric vehicle according to claim 1 to 4.

[Claim 8] The electric vehicle equipped with the terminal which carries out parallel connection of said battery to the battery of other electric vehicles in the electric vehicle according to claim 1 to 4.

[Claim 9] The auxiliary inverter which can change the direct current power from said battery into an ac output in an electric vehicle according to claim 1 to 4 by the control mode of a variable frequency and an adjustable electrical potential difference, or the control mode of fixed frequency and a fixed electrical potential difference. The 2nd output terminal for emergencies drawn from the alternating current outgoing end of said auxiliary inverter. The electric vehicle equipped with a means to supply the ac output of said auxiliary inverter operated by the control mode of a variable frequency and an adjustable electrical potential difference to electric load in the car, and to supply the ac output of said auxiliary inverter operated by the control mode of fixed frequency and a fixed electrical

potential difference to said 2nd output terminal for emergencies.

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**DETAILED DESCRIPTION**

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to an electric vehicle.

[0002]

[Description of the Prior Art] In recent years, the cure to the exhaust gas of an automobile is advanced as part of the measure of earth environmental protection. Especially, an electric vehicle attracts attention also from not only the problem of exhaust gas but a noise problem, or the field of resource saving, and a certain amount of spreading and promotion are already achieved. About the large-sized motor vehicle, the electric vehicle of the hybrid mold which combined the diesel power plant and the generator motor is tried from the problem of a battery rating.

[0003] On the other hand, when natural disasters, such as an earthquake and a typhoon, occur, a halt of the electric power supply by cutoff of a system power source has great effect on a life of people or an area in today when electrification progressed. For this reason, in order to use restrictively only a period until a system power source is restored conventionally, in the building, installing the emergency power supply system which combined the engine driven generator with the battery, or arranging the electrical power unit of an engine drive mold out in the fields is performed.

[0004] Drawing 10 shows the most typical example of 1 configuration of the electric system in an electric vehicle. The system of drawing is equipped with a battery 1, an inverter 2, AC motor 3, and a control device 4, changes the direct-current output voltage of a battery 1 into the basis of control of a control device 4 with an inverter 2 at the alternating current of an adjustable electrical potential difference and a variable frequency (VVVF), and carries out variable speed control of AC motor 3 with the alternating current output voltage. The main propeller shaft of an automobile drives with a motor 3. Energy makeup of this kind of electric vehicle, i.e., the recharge of a battery 1, must carry out a recharge over quite long time amount. If the electrical energy which cannot carry out quickly, therefore is stored in the battery 1 has been consumed unlike it of an engine drive vehicle.

[0005]

[Problem(s) to be Solved by the Invention] The power unit which consists of the battery 1 and inverter 2 in the conventional electric vehicle as shown in drawing 10 has main utilization of migration energy along with the object of automobile original. Therefore, in spite of having electrical energy required as an emergency electric supply unit generally, an electric vehicle is in the emergencies at the time of disaster generating etc, close, and electrical energy will be \*\*\*(ed) when the application as a migration means becomes migration difficulty by cutting into pieces of a route of a certain thing etc. On the other hand, although an emergency electric supply unit and, an electrical power unit are close required for an emergency, that can suffer damage and much installation or dispositions cannot use it like a system power source difficult may also arise from problems, such as a touch-down location, and facility costs, a maintenance.

[0006] Therefore, this invention is a simple configuration and aims at offering the electric vehicle which can be replaced with an emergency electric supply unit or an electrical power unit.

[0007]

[Means for Solving the Problem] In order to attain the above-mentioned object, an electric vehicle according to claim 1 is equipped with the output terminal for emergencies which derives the ac output of the AC motor driven by the ac output of a battery, the inverter which can change the dc output of this battery into an ac output by the control mode of a variable frequency and an adjustable electrical potential difference, or the control mode of fixed frequency and a fixed electrical potential difference, and the inverter operated by the control mode of a variable frequency and an adjustable electrical potential difference, and the inverter operated by the control mode of fixed frequency and a fixed electrical potential difference.

[0008] An electric vehicle according to claim 2 is equipped with the switch switched so that the ac output of the fixed frequency and the fixed electrical potential difference drawn by the output terminal for emergencies may be drawn through the coil inductance of the AC motor under shutdown in an electric vehicle according to claim 1.

[0009] The inverter with which an electric vehicle according to claim 3 can operate the dc output of a battery and this battery by the control mode of a variable frequency and an adjustable electrical potential difference, or the control mode of fixed frequency and a fixed electrical potential difference. The AC motor driven by the ac output of the inverter operated by the control mode of a variable frequency and an adjustable electrical potential difference. It has the output terminal for emergencies which derives the ac output of the AC motor operated as the ac output and generator of the internal combustion engine which does auxiliary actuation of this AC motor, and the inverter

operated by the control mode of fixed frequency and a fixed electrical potential difference.

[0010] The power converter which can drive an electric vehicle according to claim 4 as an inverter or a rectifier by the battery, the control mode of a variable frequency and an adjustable electrical potential difference, or the control mode of fixed frequency and a fixed electrical potential difference, The output terminal for emergencies which derives the ac output of a power converter by which inverter operation is carried out by the control mode of fixed frequency and a fixed electrical potential difference, While driving by the ac output of the internal combustion engine which has the capacity that an automobile can be promoted, and the power converter by which inverter operation is carried out by the control mode of a variable frequency and an adjustable electrical potential difference and propelling an automobile in collaboration with an internal combustion engine It drives with an internal combustion engine, functions as a generator, and has the AC motor which makes a battery charge by the dc output of a power converter by which rectifier operation is carried out by the control mode of a variable frequency and an adjustable electrical potential difference by considering the generation-of-electrical-energy electrical potential difference as an input.

[0011] An electric vehicle according to claim 5 is set to an electric vehicle according to claim 3, The current detection equipment which detects the output current of an inverter, and the coordinate transformation machine which divides into the active current and the reactive current the output current detected by this current detection equipment, It has the current control means which calculates the rate command for controlling the active current separated with this coordinate transformation vessel to a predetermined value, and a speed-control means to control an internal combustion engine's rate based on the rate command computed by this current control means.

[0012] An electric vehicle according to claim 6 is equipped with an electrical-potential-difference detection means to detect the output voltage of a battery, a judgment means by which the electrical potential difference detected by this electrical-potential-difference detection means judges whether it is below a predetermined value, and a means to stop the electric power supply to the output terminal for emergencies when judged with a detection electrical potential difference being below a predetermined value by this judgment means, In an electric vehicle according to claim 1 to 4.

[0013] An electric vehicle according to claim 7 is equipped with the terminal which connects external DC power supply with a battery at juxtaposition in an electric vehicle according to claim 1 to 4.

[0014] An electric vehicle according to claim 8 is equipped with the terminal which carries out parallel connection of the battery to the battery of other electric vehicles in an electric vehicle according to claim 1 to 4.

[0015] An electric vehicle according to claim 9 is set to an electric vehicle according to claim 1 to 4. The auxiliary inverter which can change the direct current power from a battery into an ac output by the control mode of a variable frequency and an adjustable electrical potential difference, or the control mode of fixed frequency and a fixed electrical potential difference, The 2nd output terminal for emergencies drawn from the alternating current outgoing end of this auxiliary inverter, It has a means to supply the ac output of the auxiliary inverter operated by the control mode of a variable frequency and an adjustable electrical potential difference to electric load in the car, and to supply the ac output of the auxiliary inverter operated by the control mode of fixed frequency and a fixed electrical potential difference to the 2nd output terminal for emergencies.

[0016]

[Embodiment of the Invention] Drawing 1 shows the operation gestalt of claim 1. The electric vehicle of drawing 1 changes the direct-current output voltage of a battery 1 into an alternating current with an inverter 2, AC motor 3 is driven at variable speed with the alternating current output voltage, and there is no difference between the place explained with reference to drawing 10, and the basic principle of driving the main propeller shaft of an automobile with a motor 3. The adjustable electrical potential difference and variable frequency (VVVF) control of the inverter 2 are always carried out by the control unit 4, and, moreover, armature-voltage control is carried out by Pulse-Density-Modulation (PWM) control. However, a control device 4 can also carry out control, i.e., a fixed electrical potential difference and fixed frequency (CVCF) control, which output the alternating current which the inverter 2 fixed to commercial frequency and a commercial electrical potential difference here. The a-contact of a switch 5 was inserted between the inverter 2 and AC motor 3, and the branch line 6 has branched through the b contact of a switch 5 from the node of an inverter 2 and a switch 5. The output terminal 9 for emergencies is drawn by the branch line 6 through the filter 7 and insulating transformer 8 of a series connection. In addition, although an inverter 2 and AC motor 3 are a three phase mold or haplotype, and it is a three phase mold here, it shall be expressed by the key diagram.

[0017] Usually, by supplying the a-contact of a switch 5, AC motor 3 is connected with an inverter 2 at the time of operation, it carries out VVVF control of the inverter 2 with the electrical energy stored in the battery 1 based on the command of a control device 4, and drives AC motor 3 with the output. While switching a switch 5 and separating AC motor 3 after considering an electric vehicle as a halt when an emergency power source is needed, you make it interlocked with, a control unit 4 is switched to CVCF control from VVVF control, and the electrical energy stored in the battery 1 is led to a branch line 6 through the b contact of a switch 5 with an PWM alternating current wave form with an inverter 2. The CVCF control output led to the branch line 6 is mostly fabricated by the sine wave with a filter 7, can be taken out from the output terminal 9 for emergencies, and can be used.

[0018] In addition, it is not necessary to be necessarily a sine wave depending on the load situation connected to an output terminal 9, and an PWM wave is still sufficient. In that case, the need of forming a filter 7 is lost. It is useful to it not only demonstrating the function for an insulation literally, but an insulating transformer 8 raising an electrical potential difference by the constant ratio, or lowering it to reverse. Furthermore, the b contact of the

switch 5 of a serial [ branch line / 6 ] omits this, it connects at a branch line 6 and the outgoing end of an inverter 2 can always generate an ac output in the output terminal 9 for emergencies. However, since a frequency and an electrical potential difference change in that case according to the travel speed of an automobile, the connection terminal 10 is formed in the power-source side of a filter 7, and the filter 7 and the insulating transformer 8 may be removed except the emergency.

[0019] According to the operation gestalt of drawing 1 described above, the electric vehicle which can be used also as an emergency electric supply unit or an electrical power unit can be offered with a simple configuration.

[0020] Drawing 2 shows the operation gestalt of claim 2. This operation gestalt adds a sinusoidal output power-source function. The contact of a switch 5 is inserted only in the plane 1 of arbitration among the three phase path cords which connect an inverter 2 and a motor 3, and the branch lines 6a and 6b of a couple are derived from the ends. Filter capacitor 7c is connected between both branch line 6a and 6b, and it connects with the output terminal 9 for emergencies further.

[0021] It is the same as that of the operation gestalt of drawing 1 described with reference to drawing 1 at the time of usual operation of the system of drawing 2. When an emergency power source is needed, after suspending an electric vehicle, it carries out off [ of the path cord which connects an inverter 2 and AC motor 3 with a switch 5 ]. The output of a plane 1 with an inverter 2 is directly led to branch line 6a which is one side by this, and the output of other phases of an inverter 2 is led to branch line 6b of another side through coil inductance 3r of a motor 3. At this time, a change-over of a switch 5 is interlocked with and a control unit 4 is switched to CVCF control from VVVF control again. By carrying out like this, the dc output of a battery 1 is led to the output terminal 9 for emergencies as a single-phase alternative current through coil inductance 3r of AC motor 3, and a filter 7 from an inverter 2. In this case, a filter is constituted for coil inductance 3r of a motor 3 combining filter capacitor 7c.

[0022] Therefore, according to this operation gestalt, since a filter is constituted for coil inductance 3r of AC motor 3 combining filter capacitor 7c, an independent filter reactor can substantially or completely be omitted, and the high single-phase power of quality can be supplied with a simple configuration.

[0023] Drawing 3 shows the operation gestalt of claim 3. This operation gestalt adds an PWM ac output power-source function. In this operation gestalt, a branch line 6 branches directly from the terminal of AC motor 3, and the branch line 6 is directly connected to the output terminal 9 for emergencies, without preparing a filter further. Moreover, the internal combustion engine 11 for auxiliary actuation is connected with the motor 3.

[0024] Usually, while making an inverter 2 generate an PWM ac output based on the command of a control device 4 and driving AC motor 3 by the dc output of a battery 1 at the time of operation, auxiliary actuation of the internal combustion engine 11 is carried out. When an emergency power source is required, a control unit 4 is operated as an AC generator which is switched to CVCF control from VVVF control and by which drives AC motor 5 with an internal combustion engine 11, and synchronized operation is both carried out to an inverter 2, and an PWM ac output is supplied to an output terminal 9 by an internal combustion engine's 11 speed control.

[0025] Since [ according to this operation gestalt / without forming a switch between a motor 3 and an inverter 2 / both ] it has always connected, simplification of a configuration and simplification of a functional switch can be attained. Moreover, since the generation of electrical energy by the internal combustion engine is possible, alternating current power can be supplied to stability as an emergency electric supply unit for a long time.

[0026] Drawing 4 shows the operation gestalt of claim 4. About a hybrid electric vehicles, using power converter 2U which can perform inverter operation or rectifier operation selectively instead of an inverter 2, this operation gestalt inserted the switch 5 between that power converter 2U and motor 3, and has connected the internal combustion engine 11 with the motor 3 further. Furthermore, the output terminal 9 for emergencies is directly drawn from the outgoing end of an inverter 2 through the branch line 6.

[0027] Close [ of the a-contact of a switch 5 ] is carried out at the time of operation, it carries out VVVF control of the inverter 2 with a control device 4, and is always driven at variable speed in AC motor 3. It is separated from the motor 3 by the clutch which an internal combustion engine 11 makes usually race, or is not illustrated.

[0028] When an emergency power source is required, while suspending automobile operation, off [ of the contact of a switch 5 ] is carried out. CVCF control of the inverter 2 is carried out with a control device 4, and the alternating current power of commercial frequency and a commercial electrical potential difference is taken out from an output terminal 9. When a battery 1 causes capacity lowering in this operation gestalt, it is a basis in emergency-power-source the condition of automobile shutdown and not using it, and close [ of the switch 5 ] is carried out, a motor 3 is driven for power converter 2U with a switch and an internal combustion engine 11 to rectifier operation through a control unit 4, and this is operated as a generator further again. By this, the generation-of-electrical-energy electrical potential difference of the motor 3 of generator operation will be led to power converter 2U of rectifier operation through a switch 5, it will be direct-current-ized here, and a battery 1 will be charged.

[0029] In this operation gestalt, a battery 1 is charged for the generated output of the motor 3 which drove with the internal combustion engine 11 and was generated. If charge is completed, an internal combustion engine 11 is suspended, off [ of the switch 5 ] will be carried out, a motor 3 will be separated, and the output voltage will be led to the output terminal 9 for emergencies as inverter operation of CVCF control of power converter 2U. By carrying out like this, prolonged utilization of the simplification of the control approach and an emergency power supply can be aimed at.

[0030] Drawing 5 shows the operation gestalt of claim 5. The equipment of drawing 5 enables it to control the output current of an inverter 2 as much as possible to it on the basis of the equipment of drawing 3. A current transformer 20 and the current detector 21 detect the output current of an inverter 2, sinusoidal command sin

theta\* which synchronized with the output voltage of the detection current and inverter 2 is inputted into the coordinate transformation machine 22, a three phase circuit/2 phase-number conversion is performed here, and a detection current is divided into the reactive current component  $i_d$  and the active current component  $i_q$ . Torque current command value  $i_q^*$  and a comparator 23 compare the active current component  $i_q$  as a torque current component of a motor 3, and the difference ( $i_q^* - i_q$ ) is inputted into the current control amplifier 24, and the speed is controlled in an internal combustion engine 11 through a speed regulating device 25 so that the difference may be made into zero. In that case, it is controllable by making torque current command value  $i_q^*$  into zero to lose carrying out of the active current from a battery 1.

[0031] Drawing 6 shows the operation gestalt of claim 6. This operation gestalt shows the example of 1 configuration of the electric vehicle which added the emergency-power-source function with load limitation to a battery 1. In the equipment of drawing 6, the electrical-potential-difference detector 14 detects the output voltage of the battery 1 connected to the inverter 2. If the detection value descends even to the programmed voltage beforehand calculated from the accumulation-of-electricity residue, it will judge that it is [ generation-of-electrical-energy capacity ] insufficient with judgment equipment 15, and an inverter 2 will be suspended through a control device 4 by the judgment result.

[0032] According to this operation gestalt, after using an emergency power source, it can leave the electrical energy to an automobile which can be run by himself to a battery 1.

[0033] Drawing 7 shows the operation gestalt of claim 7. This operation gestalt draws the connection terminal 16 from the mounted battery 1, and enables it to connect external DC power supply 17 to that connection terminal 16. External DC power supply 17 may be mass DC power supply currently prepared for the service station of an electric vehicle etc., and although a mass battery may be used, you may be the power unit which receives an alternating current, rectifies through a rectifier and is graduated through a filter.

[0034] The mode of operation in regular automobile operation of the equipment of drawing 7 is completely the same as that of the equipment of drawing 3. When carrying out off [ of the switch 5 ] and using the emergency-power-source function using an output terminal 9, external DC power supply 17 can be connected to the connection terminal 16, the energy shortage of the mounted battery 1 can be compensated, and prolonged utilization of an emergency power source can be enabled.

[0035] Drawing 8 shows the operation gestalt of claim 8. This operation gestalt shows the example of 1 configuration in the case of performing parallel connection of DC power supply using two or more electric vehicles. With the equipment of drawing 8, one (converter of the beginning or the last) or two connection terminals 16a and 16b are drawn from the outgoing end of each batteries 1a, 1b, and 1c of two or more sets of the electric vehicles, distinguished by Suffixes a, b, and c and —. When performing parallel connection, the contiguity stop of each electric vehicle is carried out, parallel connection of each batteries 1a, 1b, and 1c and — is carried out, and a total power supply is made to increase by connecting path cord 18ab, 18bc, 18cds, and — to the connection terminals 16a and 16b. Moreover, supplying power to an external load by combining the hybrid car which connected internal combustion engine 11a as illustrated to No. 1, and considering the hybrid car as charge operation using the internal combustion engine by VVVF control, the batteries 1b and 1c of other electric vehicles (No. 2, No. 3) can be charged, and prolonged feed is attained. In addition, in drawing, an arrow head shows the flow direction of power.

[0036] According to this operation gestalt, a power supply can be increased by carrying out parallel connection of the DC power supply of two or more sets of electric vehicles. Moreover, by combining a hybrid car, the DC power supply of other electric vehicles can be charged, and a prolonged activity can be enabled as an emergency power source.

[0037] Drawing 9 shows the operation gestalt of claim 9. This operation gestalt shows the example which put side by side the AC-power-supply equipment for supplying power to mounted alternating current load 3b. Two power systems are prepared in the equipment of drawing 9, and the 1st system (suffix a) is the hybrid mold which connected internal combustion engine 11a with AC-motor 3a. Auxiliary inverter 2b connected in the form where the 2nd system (suffix b) branches from the direct-current terminal of power converter 2ua of the 1st system. Switch 5b and alternating current load 3b are connected to a serial one by one, and the 2nd output terminal 19 for emergencies is further drawn from the alternating current terminal of auxiliary inverter 2b instead of the output terminal 9 for emergencies. Alternating current load 3b is a motor, a floodlight, etc., which drives the blower and refrigerator compressor of mounted air conditioner attachment, and it deals in it.

[0038] In the equipment of drawing 9, power is usually supplied to alternating current load 3b through auxiliary inverter 2b and switch 5b from battery 1a. VVVF control of the auxiliary inverter 2b is carried out by control unit 4b. When taking out a power source outside, alternating current load 3b is separated by switch 5b, and power is supplied to an output terminal 19. Auxiliary inverter 2b is switched to OVGF control by control unit 4b in that case.

[0039] According to this operation gestalt, power can be supplied outside with a simple configuration by using the AC power supply for mounted loads.

[0040] Each operation gestalt described above can be used as an alternate power source in the location where system power sources (source power supply), such as not only an accident prevention application but a leisure application and a depopulated district, and a backward region, are not acquired, or the location where a power source is unstable.

[0041]

[Effect of the Invention] Since the automobile incorporated by everyday life by adding an emergency-power-source function to the electric vehicle used every day is used according to this invention as stated above, the spread of

emergency power supply systems can be aimed at with the spread of electric vehicles. Moreover, since the facility and its maintenance only for emergencies are unnecessary, improvement in profitability can be aimed at.

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**DESCRIPTION OF DRAWINGS**

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**[Brief Description of the Drawings]**

- [Drawing 1] The connection diagram showing the operation gestalt of the electric vehicle of claim 1.  
[Drawing 2] The connection diagram showing the operation gestalt of the electric vehicle of claim 2.  
[Drawing 3] The connection diagram showing the operation gestalt of the electric vehicle of claim 3.  
[Drawing 4] The connection diagram showing the operation gestalt of the electric vehicle of claim 4.  
[Drawing 5] The connection diagram showing the operation gestalt of the electric vehicle of claim 5.  
[Drawing 6] The connection diagram showing the operation gestalt of the electric vehicle of claim 6.  
[Drawing 7] The connection diagram showing the operation gestalt of the electric vehicle of claim 7.  
[Drawing 8] The connection diagram showing the operation gestalt of the electric vehicle of claim 8.  
[Drawing 9] The connection diagram showing the operation gestalt of the electric vehicle of claim 9.  
[Drawing 10] The connection diagram of the electric vehicle by the conventional technique.

**[Description of Notations]**

- 1 Battery
- 2 Inverter
- 2b Auxiliary inverter
- 3 AC Motor
- 3b Alternating current load
- 4 Control Unit
- 5 Switch
- 6 Branch Line
- 7 Filter
- 8 Insulating Transformer
- 9 Output Terminal for Emergencies
- 11 Internal Combustion Engine
- 14 Electrical-Potential-Difference Detector
- 15 Judgment Equipment
- 16 Connection Terminal
- 17 External DC Power Supply
- 19 Output Terminal
- 20 Current Transformer
- 21 Current Detector
- 22 Coordinate Transformation Machine
- 23 Comparator
- 24 Current Control Amplifier
- 25 Speed Regulating Device

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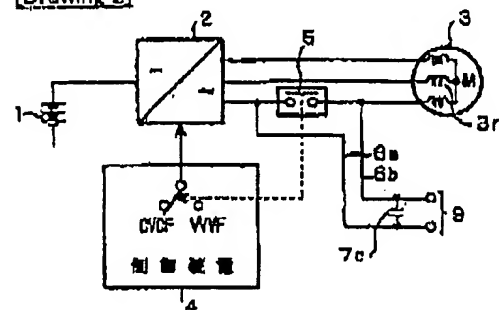
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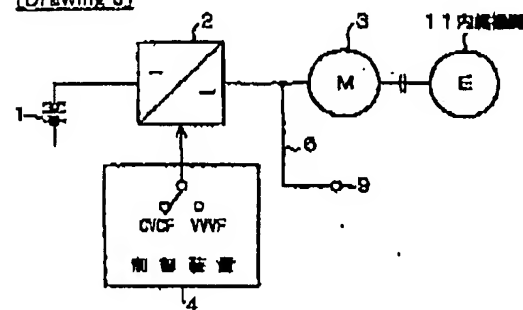
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DRAWINGS

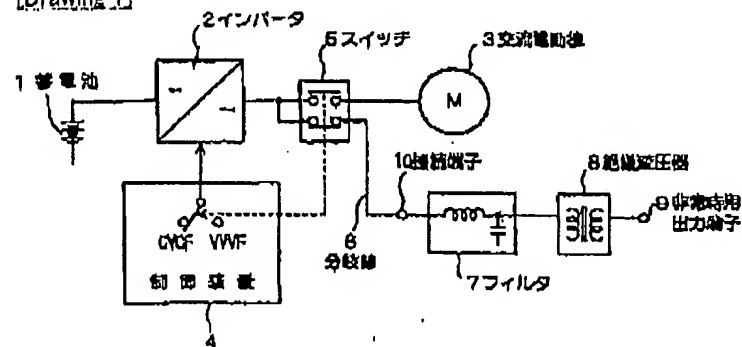
[Drawing 2]



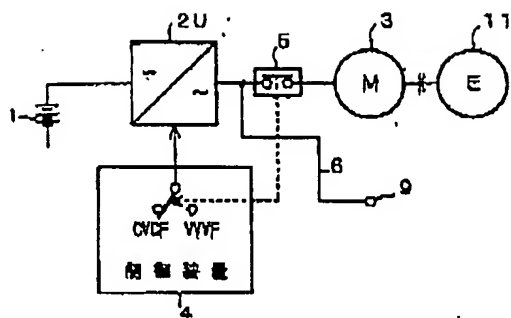
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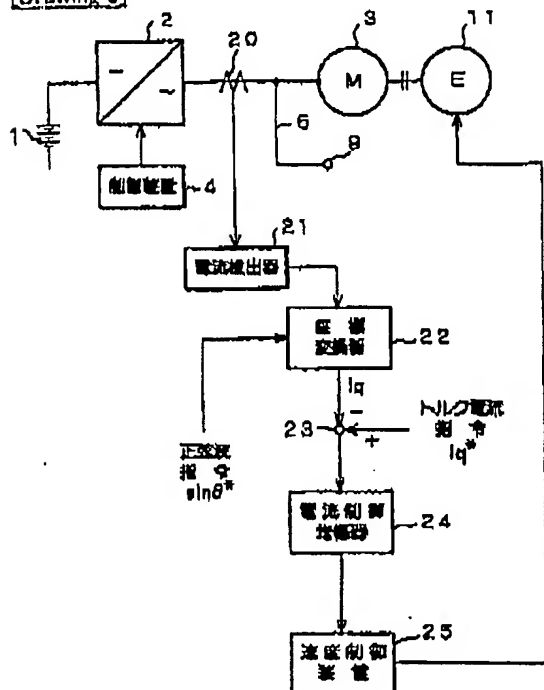
[Drawing 1]



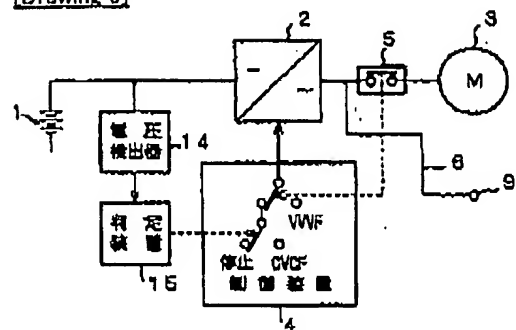
[Drawing 4]



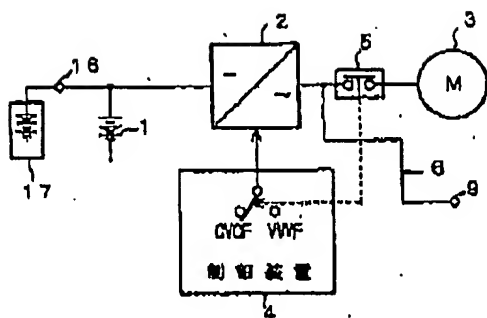
[Drawing 5]



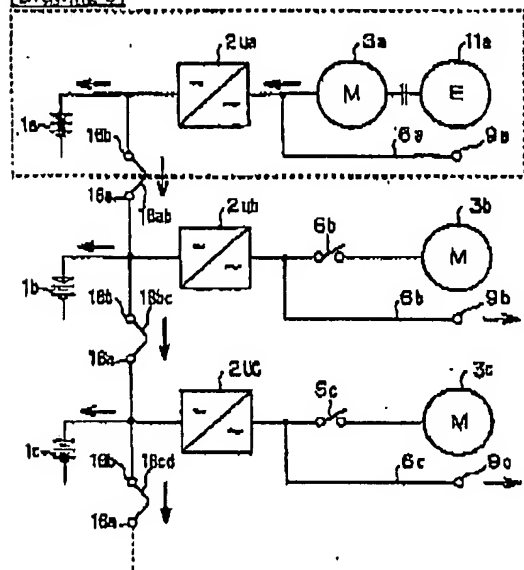
[Drawing 6]



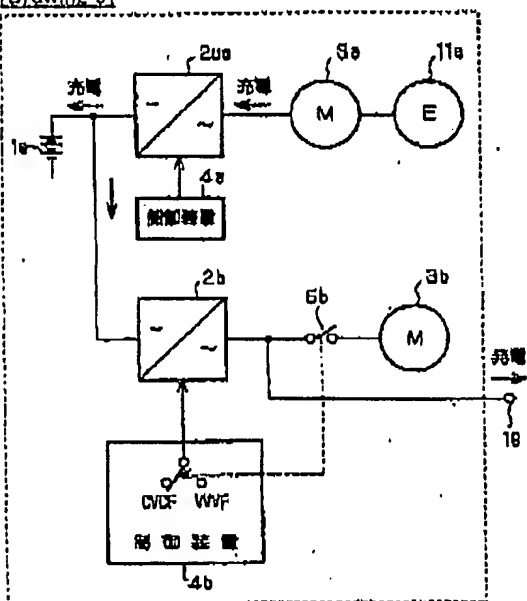
[Drawing 7]



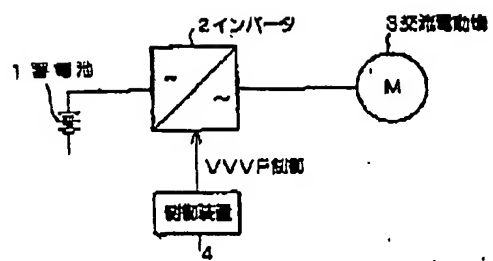
[Drawing 8]



[Drawing 9]



[Drawing 10]



[Translation done.]

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